CLAIMS

What is claimed is:

1. An apparatus for evaluating the characteristics of a sample, comprising:

an intensity modulated pump beam, said pump beam being directed to a first spot on the surface of the sample for periodically exciting the sample;

a probe laser beam being directed to a second spot on the surface of the sample;

a tracker module capable of adjusting a lateral displacement of said first and second spots on the surface of the sample;

a fixed beam combiner for combining the pump beam and the probe beam;

a common objective lens for focusing the pump and probe beams to the respective first and second spots on the sample;

a detector for measuring a modulated power of the reflected probe laser beam and generating first output signals in response thereto; and

a processor for signaling the tracker module to adjust the lateral displacement of said first and second spots, the processor further evaluating the characteristics of the sample based the first output signals obtained for at least two different lateral displacements of the first and second spots.

2. An apparatus according to claim 1, wherein:

the beam combiner is a dichroic mirror.

3. An apparatus according to claim 1, further comprising:

a probe shutter positioned along the probe beam path before the probe beam reaches the fixed beam combiner.

4. An apparatus according to claim 1, further comprising:

a pump shutter positioned along a pump beam path before the pump beam reaches the fixed beam combiner.

5. An apparatus according to claim 1, wherein:

each of the pump beam and the probe beam is linearly polarized.

6. An apparatus according to claim 1, further comprising:

an autofocus system for adjusting a spot size of at least one of the pump or probe beams on the surface of the sample, the processor further capable of signaling the autofocus system to adjust the spot size.

7. An apparatus according to claim 1, further comprising:

an array photodetector for measuring the intensity of the reflected probe laser beam and generating second output signals as a function of the angle of incidence on the sample.

8. An apparatus according to claim 7, wherein:

the processor evaluates the characteristics of the sample based on a combination of the first and second output signals.

9. An apparatus according to claim 1, wherein:

the processor signals the tracker module to adjust the lateral displacement of said first and second spots based on a measurement algorithm.

10. An apparatus according to claim 9, further comprising:

an autofocus system for adjusting a spot size of at least one of the pump and probe beams on the surface of the sample, the processor further capable of signaling the autofocus system to adjust the spot size based on the measurement algorithm.

11. An apparatus according to claim 9, further comprising:

a frequency synthesizer for adjusting a modulation frequency of the pump beam, the processor further capable of signaling the frequency synthesizer to adjust the modulation frequency based on the measurement algorithm.

12. An apparatus according to claim 9, wherein:

the measurement algorithm determines at least one parameter selected from the group consisting of a number of different lateral displacements, the distance of each lateral displacement, a number of measurements at each lateral displacement, a number of spot sizes at each lateral displacement, the spot sizes at each lateral displacement, a number of modulation frequencies at each lateral displacement, and the modulation frequencies at each lateral displacement.

13. An apparatus according to claim 12, further comprising:

an interface for adjusting the at least one parameter determined by the measurement algorithm.

14. An apparatus as recited in claim 1, wherein:

the tracker module adjusts the lateral displacement such that sample measurements are taken as the lateral displacement between the pump and probe beam spots is continuously changed.

15. An apparatus as recited in claim 1, wherein:

the tracker module adjusts the lateral displacement such that sample measurements are taken at discrete separation intervals.

16. An apparatus as recited in claim 1, wherein:

the tracker module adjusts the lateral displacement such that the spacing between the pump and probe beam spots is varied over a range from an aligned overlapping position to a spacing of at least 10 microns.

17. An apparatus as recited in claim 1, wherein:

a modulation frequency of the pump laser beam can be varied from 100 KHz to 100 MHz.

18. An apparatus as recited in claim 1, wherein:

the tracker module adjusts the lateral displacement by adjusting a direction of one of the probe beam and the pump beam.

19. An apparatus according to claim 18, wherein:

the fixed beam combiner combines the pump and probe beams after the tracker module adjusts the lateral displacement.

20. An apparatus according to claim 1, wherein:

one of the at least two different lateral displacements is a lateral displacement of zero distance, such that the first and second spots at least partially overlap.

21. A method of evaluating characteristics of a sample comprising the steps of:

directing an intensity modulated pump laser beam to a first spot on the surface of the sample for periodically exciting the sample;

directing a probe laser beam to a second spot on the surface of the sample near a region that has been periodically excited and is reflected therefrom;

adjusting the lateral separation of the first and second spots using a tracker module;

combining the pump beam and probe beam using a beam combiner;

focusing the pump and probe beams on the sample using a common objective;

measuring a modulated power of the reflected probe beam at each of a number of lateral separations between the first and second spots and generating an output signal in response thereto; and

evaluating the characteristics of the sample based on the output signals obtained for at least two different lateral separations of the first and second spots

22. A method according to claim 21, wherein:

the lateral separation is adjusted according to a measurement algorithm.

23. A method according to claim 21, wherein:

the lateral separation is adjusted continuously.

24. A method according to claim 21, wherein:

the lateral separation is adjusted such that sample measurements are taken at discrete separation intervals.

25. A method according to claim 21, further comprising:

adjusting a spot size of at least one of the pump or probe beams at each lateral separation and measuring the power of the reflected probe beam at each adjusted spot size.

26. A method according to claim 21, further comprising:

adjusting a modulation frequency of the pump beam at each lateral separation and measuring the power of the reflected probe beam at each adjusted modulation frequency.

27. A method according to claim 21, further comprising:

selecting a measurement algorithm for determining at least one parameter selected from the group consisting of a number of different lateral displacements, the distance of each lateral displacement, a number of measurements at each lateral displacement, a number of spot sizes at each lateral displacement, the spot sizes at each lateral displacement, a number of modulation frequencies at each lateral displacement, and the modulation frequencies at each lateral displacement.

28. A method according to claim 21, wherein:

combining the pump beam and directed probe beam includes using a dichroic mirror.

29. A method according to claim 21, further comprising:

shuttering one of the probe beam and the pump beam before the beam combiner.

30. A method according to claim 21, wherein:

adjusting the lateral separation of the first and second spots using the tracker module includes directing one of the pump beam and the probe beam.

31. A method according to claim 30, wherein:

combining the pump beam and probe beam using a beam combiner occurs after the tracker module adjusts the lateral separation.

32. A method according to claim 21, wherein:

one of the at least two different lateral separations is a lateral separation of zero distance, such that the first and second spots at least partially overlap.